EXECUTIVE SUMMARY

The Government of Armenia (GOA) has recognized for some time that:

(i) household expenditures for winter heating are a significant source of poverty, particularly in urban areas as the housing construction offers few alternatives for affordable and safe heating;

(ii) the continued provision of district heating by public entities to about 10% of the population, with virtually no enforcement of payment, constitutes an unfair "subsidy" to consumers and lacks accountability on the part of the service providers; and

(iii) excessive reliance on costly electricity for heating has high economic costs and will be increasingly unaffordable as tariffs are adjusted to cover high costs of asset replacement, particularly when the Medzamor nuclear power plant is retired; and

(iv) easy access to affordable and safe heating services will help create a healthy and productive environment necessary for poverty alleviation.

Therefore, as part of its Poverty Reduction Strategy, the GoA undertook to prepare an Urban Heating Strategy (UHS) to facilitate access to efficient, clean, safe and affordable heating services. Preparation of the strategy was initiated in early 2001 under the leadership of the Ministry of Finance and Economy which combined a variety of initiatives and funding sources to help prepare this strategy. The Government adopted the UHS on September 5, 2002 (Decree 1384 N).

The *primary objective* of the UHS is to facilitate access to affordable, safe and environmentally sustainable heating services by creating the market conditions for the commercial provision of these services. A *secondary objective* is to stimulate residents of multi-apartment buildings to organize themselves in a manner which would facilitate commercial provision of communal services on affordable terms. The UHS provides the strategic framework for the short and medium term development of the Armenian urban heating sector. The overarching tenet of the strategy is that the state has to get out of the business of providing heat and other communal services through either the direct operation of such companies or the extensive subsidization of such services. Instead its role is in the regulation and supervision of service providers, provision of information to enable the creation of markets, removal of other bottlenecks in the creation of markets and support of low-income families. The organization of apartment owners in condominiums or similar community-based organizations is considered a necessary requirement for a more efficient provision of affordable communal services in general and heating services in particular.

Background

During the 1990s, most of the district heating systems which had supplied winter heating and year-round hot water in the towns and cities, to at least 50% of the country's population, fell into disrepair due largely to the effects of the economic blockade. Since the mid-1990s, national and urban authorities have restored district heating services to eight municipalities, attempting to cut supply costs, charge cost-reflective tariffs and enforce payment. This has helped reduce somewhat the fiscal burden and asset depletion associated with this heating service, but cost

recovery has remained unsustainable. As a result, less than 10% of the population currently receive heat from district systems. However, even this restricted supply is provided in a non-commercial manner with virtually no accountability for supply or consumption (for example, absence of any metering) and weak mechanisms for enforcing payment. Non-payment amounted to about US$10-12 million annually (about 0.5% of GDP) until a few years ago and resulted in the central government having to clear arrears of the heating companies to their fuel suppliers.

The rest of the population (more than 90%) resorts mostly to individual heating solutions such as electric heaters or fuelwood stoves in urban and rural areas, supplemented by dung and waste in rural areas. Electric heating is expensive and enjoys a high degree of payment enforcement, making it an option only for the relatively better off. The urban poor are left to burning fuelwood, often in apartment buildings constructed without adequate ventilation for wood burning, with detrimental health implications and accelerated deforestation of already strained forestry resources. On the positive side, consumption of both electricity and wood can be easily controlled to match income constraints and comfort preferences.

Methodology for Developing an Urban Heating Strategy. Recognizing that heating is a local issue, typically dependent on local climatic conditions, housing density, and natural, human and financial resources, the Government selected four cities - Yerevan, Charentsavan, Gyumri and Jermuk - for the development of individual heating strategies from which to crystallize a national Urban Heating Strategy (UHS). The cities lie in different geographical zones of the country, Yerevan having the mildest climate and Gyumri/Jermuk the coldest.

The *methodology* for developing the heating strategy consisted of:

(a) an assessment of *coping strategies* of households. A demand assessment was carried out on the basis of two household surveys (1999 and 2001). The second survey which concentrated on the four target cities listed above, included also an environmental and health component;

(b) A *technical-economic assessment* of heat supply options. This was carried out in two phases.

- First, a *baseline* was established, estimating the costs of providing heat from the existing infrastructure in the short and medium term without any further investments. Also investigated was the institutional environment in which heat supply takes place and which constitutes powerful barriers to the sustainable provision of heat. The results were presented and discussed at national workshops to reach a consensus before starting the second phase.
- Second, the costs of different options for providing heat over the long term were estimated, assuming necessary investments in heat and gas supply infrastructure. Feasible supply options were identified based on their ability to provide heat at a cost that is affordable to a large part of the population (as revealed through the consumer surveys).

(c) Outlining a *phased implementation strategy*. The strategy recommended actions, especially actions which can be taken in the short/medium term to eliminate institutional and information barriers that are preventing consumers from accessing affordable heating services and suppliers from offering these services in an innovative, safe and sustainable manner.

Specific challenges for improving heating in Armenia

Providing access to heating to the Armenian urban population is encountering problems on many levels. They pose powerful constraints in identifying solutions to providing improved access to sustainable heat supply.

- Only little more than 10% of the urban population in Armenia are connected to functioning district heating (DH) networks, with connection relatively even spread among income groups within most urban neighborhoods. For those households not connected to functioning DH networks, where family income influences heating choice, the poor are more likely to use wood, dung or other relatively "dirty" fuels, while the non-poor rely on clean fuels such as electricity and natural gas. People not on DH networks also heat less of their living space and choose lower room temperatures.
- Energy consumed for space heating accounts for about 45 percent of an urban household's annual energy consumption (on average). Heating accounts for about 5 percent of household spending on average, but the poor spend almost twice as much of their household budgets on heating compared with the non-poor – about 6 percent compared to 3 percent. In absolute terms non-poor households declared spending about AMD 16,500-27,500 (USD 30–50) a year on heating, while poor households declared spending about AMD 13,750-22,000 (USD 25–40).
- Poor households also suffer non-monetary costs. These include the health costs associated with not having enough heat and the resulting productivity losses and the health costs associated with burning dirty fuels in inadequately ventilated environments. In addition, the heavy use of fuelwood leads to environmental costs associated with deforestation, and the opportunity costs of time spent collecting heating material—especially wood.
- Few households pay for their district heating. According to consumer surveys, household bills for DH averaged AMD 35,000–42,900 a year. Spending on DH, however, was estimated to be considerably less, AMD 22,000–26,000 a year, because many households do not pay their full bills for centralized heating. It is estimated that the government (through the clearance of arrears for fuel, taxes, and other payables or under-maintenance of assets) currently spends about AMD 3.3 billion (about USD 6 million) annually to subsidize the ailing district heating systems in the four cities alone.
- Income levels of households within the same apartment buildings can diverge widely, making the identification of and agreement on joint solutions difficult. This problem is aggravated by the large number or absentee owners which is widespread in Armenia, unlike in any other country of the FSU. A flexible housing market which would go a long way in resolving the income divergence and absentee problems is slow in materializing.
- The transfer of building ownership from municipalities/government to apartment residents has left a vacuum with nobody being responsible or able to maintain buildings, especially the common spaces, and organizing the provision of communal services effectively. The legal framework is fairly advanced after recent amendments, but it is still not adequate for efficient operations of those community associations taking over responsibilities. Contracts for typical communal services such as heating, water supply, garbage removal are still concluded with the individual household, rather than more effectively with an association of homeowners.
- Not only the heat supply infrastructure, but also the building infrastructure is deteriorating due to lack of maintenance and lack of inadequate heating. Buildings are badly insulated and therefore require a large heat input for even a minimal comfort. Centralized heating systems are misused by almost all consumers who bleed hot water from radiators because of poor municipal water service and because it is an easy if illegal source for hot tap water. The potentially clean, efficient and not too expensive alternative of natural gas heating is

hampered by the discontinuation of gas supply to apartment buildings because of unsafe physical condition of the existing gas infrastructure and the poor creditworthiness of customers who lack funds for investing in alternative supply options.

- The existing heat service providers are inflexible, bankrupt municipal heating companies which mostly lack a commercial attitude. Alternatives, for example small private businesses, have been very slow to emerge since there is little experience with alternative heating options, all heat supply currently is regulated heavily by the Energy Commission, access to financing is non-existing, potential customers present a big risk both in terms of diversity and payment attitudes, and the time horizon necessary to recoup investments is considerably longer than contract periods that customers can reasonably be expected to sign up for.
- The extensive use of electricity for heating purposes doubles peak demand during the winter months subsequently increases cost of electricity production and need for investment in generation and distribution assets. In the long-term this would increase the cost of electric heating even more.

Affordable Heating Options: Short-term and Long-term Results

The analysis of heating options (see box below) was done in two steps. In a *short/medium-term analysis*, covering 5 years, the objective was first to assess the existing heat supply structure, covering technical, financial, fiscal and institutional aspects; in a second step it was investigated whether heating options would be able to deliver heat sustainably according to the affordability constraints. No investments except minor ones were assumed for existing heating infrastructure.

For the *long-term analysis* the costs of providing heat were determined for all heat supply options, including those investments ensuring that the equipment would be functional for at least 20 years and upgrades in the necessary natural gas infrastructure. Two different demand levels were investigated, normative heat demand and reduced heat demand. The scenario with *normative heat demand* uses the Armenian (Soviet) SNIP norms for heat consumption in each type of standard building including the consumption of 50 liter per person per day hot tap water (HTW), recognizing that people currently tap water illegally from the radiators for HTW purposes. The scenario with *reduced heat demand* is copying the way heat is being consumed in households with individual heating (electricity and wood/solid fuels), i.e. people are heating a small part of the flat and most of the flat has a temperature much lower than the "normative" comfort temperature (20°C). The normative space heating demand is reduced by 50% and the HTW demand is totally eliminated. The total reduction is around 60% of the normative heat demand.

Heat Supply Options Investigated

1. Rehabilitation/modernization of the existing *centralized* (*district) heating systems*. Heat and domestic hot water is produced in gas-based combined-heat-and-power (CHP) plants or large or small heat-only boilers and delivered to buildings through a network of hot-water pipes.
2. *Autonomous heating systems* where small-capacity gas-based CHP or boiler-plants supply heat and hot water to 1-3 multi-apartment buildings.
3. *Individual* heating of apartments (and individual houses), based on electricity, natural gas, wood or other available fuels.

In the *short-term* the existing centralized supply options, adopting a minimum investment strategy and providing heat according to the reduced demand option, would be able to supply heat at the lowest cost of about 40,000 AMD annually per household. However, this is not a long-term

solution since existing solutions may be financially cheap but have a rising economic cost. Furthermore, any public or condominium infrastructure used to supply heat will continue to deteriorate without additional investments.

In the *long-term* new heat networks for a few buildings supplied from gas-fired autonomous boilers have the lowest supply cost, ranging from 50,000-70,000 AMD depending on the demand level (reduced or normative). From the affordability analysis, it appears, however, that very few people (probably less than 10% of households) would be able to pay for the normative heat supply and that only around 30% of the population would be able to afford even the reduced supply solution.

Heating with individual wood stoves is always one of the cheapest solutions even though it cannot compete in cleanliness and convenience. Individual electric heaters result in very expensive heating, even at a reduced demand level. The cost of individual heating with natural gas in the long-term is comparable to the cost of the autonomous gas boiler option.

Urban Heating Strategy

The Urban Heating Strategy (UHS) adopts a phased approach, based on the results of the technical and affordability analysis and the necessary changes in the institutional framework. The strategy proposes a *first phase* (*Survival, years 1-2*) during which the framework for a market-based provision of heating services is put in place, including testing whether consumers opt for existing centralized heat supply under conditions which permit full commercialization of centralized heating services and whether private providers of autonomous heating services emerge. This phase is followed by a second phase (*Recovery, years 3-5*) when the surviving centralized heating systems coexist with new heating options. Finally, experience from Phases 1 and 2 is expected to generate during the third phase (*Growth, years 6-25*) large-scale demand for affordable heating solutions - decentralized heating systems and possibly investments for DH modernization - mostly provided by the private sector with major improvements in service quality and coverage.

Especially in the first two phases the actions proposed under the UHS (see table below) are "soft", concentrating of providing information to consumers and (potential) suppliers, eliminating legal, regulatory, and other institutional barriers to commercial and competitive heating options, enabling low-cost investment and setting the stage for more substantive investment in the third phase. This phasing is considered necessary since the heat market in Armenia today is largely dysfunctional, with most consumers fending for themselves and the municipal heat suppliers de facto bankrupt, unable to supply more than 10% of the population with a service that keeps deteriorating and unable to collect more than a small fraction of the cost of centrally supplied heat. The UHS therefore has to overcome considerable barriers, ranging from lack of information, income, and creditworthy consumer institutions (condominiums) on the consumer side, to the lack of information on technical options or an enabling legal and regulatory framework for commercial provision of heating services by private suppliers.

Table: UHS Phases and Actions

Phases UHS Key Aspects	Survival (Y1+Y2)	Recovery (Y3 - Y5)	Growth (Y6 - Y25)
Regulation/market stimulation	Improve legal base for condominiums and adopt appropriate regulatory rules for different heat market segments	Stimulate and support embryonic heat market actors	Market monitoring
Institutional	Restructure CH companies / full cost recovery/accountability Develop condominium assistance program and implement pilot projects, especially on demand side	Commercialization/ privatization of CH companies All collective heat consumers organized in condominiums and cooperatives	- -
Social	Develop social support scheme	Social support scheme operational	Social support scheme is phased out over suitable period
Technical All heating systems		If systems viable, introduce individual control & cost-allocation devices	Individual control is commonplace
Remaining DH systems	Disconnect risers to reduce supply costs, reduce heated area, install meters	Development dependent on market demand and full commercialization of DH entities	Improvements of CH infrastructure based on market demand and commercial financing
Other	Implement several building-level pilot projects	Simple demand side management measures implemented in buildings	Comprehensive building insulation and improvements Introduction of solar energy solutions for HTW
Gas Infrastructure	Coordinate with pilot projects	Upgrade as necessary to support heating investments	
Promotional	Implement comprehensive public awareness campaign Promote improved wood stoves	Continue information campaigns	-
Financial	Set up affordable financing schemes for condominium heat infrastructure and private heating service providers	Mainstream access to affordable financing by condominiums and private heating service providers.	Phase out any sovereign guarantees associated with condominium and heat supply financing schemes

If *centralized heating* is to be continued at all, modifications will have to be made in the way it is supplied to consumers in order to provide affordable quantities and quality of heat without continuing widespread subsidies; i.e., the provision of heat has to be controlled by the consumer, it has to be flexible and it has to be billed based on metered consumption. A low-tech and low-cost approximation of "flexible heating" would be to restrict supply to only one or two room radiators in each apartment (instead of 3-4), delivering a temperature of about 17 degree Celsius (assuming reasonable insulation), and disconnecting the remaining vertical risers. Adopted for an entire centrally heated area, this should cut down considerably on fuel costs that have a cost share of 70-80%. This is however only an interim strategy, suggested in order to buy time for putting in place the basic framework for a more market-driven heat supply. The large investments needed to extend the life of centralized heating systems would make these systems much less competitive

compared to autonomous and individual options, and expose them to a higher degree of market risk.

Decentralized heating (autonomous systems) and *individual* natural gas heating should be promoted in all areas and allowed to compete with centralized heat supply options under a sensible institutional framework. The high initial costs associated with these options may, however, render them unaffordable for the majority of the population until economic growth improves the general purchasing power.

Recognizing that many households may be unable in the short/medium term to participate in collective, condominium-based arrangements or afford clean individual heating options, the government may wish to consider reducing barriers for the development and marketing of *efficient wood stoves* which are better designed for use in multi-apartment dwellings than the existing stoves. However, the environmental implications of continued wood burning would need to be carefully assessed.

Low-cost insulation of buildings should be encouraged by systematically eliminating informational, institutional, financing and affordability barriers. There are many measures such as (re-)installation of windows and doors in the staircases or tightening of window frames that are very low-cost and/or have a short pay-back time and that could partially be done by residents themselves. However, functioning condominiums may need to be in place to capture the full benefits of these measures.

Institutional and regulatory framework elements to overcome barriers to affordable heating

Condominiums. The strategy is based on the fact that heating in multi-apartment residential buildings in urban areas is best provided centrally, as a communal service (with the possible exception of individual natural gas stoves). At a minimum, each building should have its own central supply. The provision of central heating and other communal services is much facilitated if the dwellers are organized in order to make joint decisions and be able to act as a single entity in their commercial relations with a service providers. About 50% of multi-apartment buildings in Armenia are currently organized as condominiums. The overwhelming majority of these condominiums, however, exist only on paper, and the few active ones encounter severe limitations in the services they can provide to their members due to institutional constraints and lack of access to financing.

Households in multi-apartment buildings therefore need support to organize effectively, for example as condominiums and other forms of community-based groups, and then to receive training to be able to manage their buildings and contract communal services. This would include, but not be restricted to the following:

- Legal changes to make condominiums more functional;
- Establishment of special advisory centers and community activists for mobilizing urban households to form condominiums and other forms of community organizations;
- Access to financing for building improvements and possibly for investment in community infrastructure;
- Provision of income support to low-income and vulnerable households (through an enhancement of the family benefit program) to meet their condominium obligations;
- A sustained broad information campaign and public education program, drawing on experience from demonstration projects.

Such better prepared condominiums could then become effective counterparts for heat and other communal service providers. Experience from other countries (e.g. Lithuania) indicates that establishment and strengthening of condominiums is important and could be the centerpiece of a successful heating strategy. The condominium should be legally responsible for providing heating to all its members, either by operating its own boiler and internal distribution system or by contracting out this service. It would also be responsible for managing heat distribution inside the building, billing its members for communal services provided to the condominium and for collecting payments from individual households and for full and timely payment to the heat supply company. If the heat is not paid, the supply to the whole building is cut.

The Energy Regulatory Framework. The UHS proposes a much more market-based and competitive provision of heating services to which the legal and regulatory framework for the sector needs to be adapted. Centralized heating services (district heating) will continue to be regulated by the Energy Commission which will continue to be responsible for licensing, both technical and economic. It will provide the methodology for heat tariff setting and will approve heat tariffs proposed by suppliers. Billing should be based on metered consumption with a two-part tariff. Decentralized (autonomous) heating services will be based entirely on commercial contracts between supplier and customer. Suppliers will have to receive a technical license from the Energy Commission, ensuring that their equipment and supply systems meet safety and environmental standards. They may also be required to submit key performance data to the Commission which could help consumer protection groups to evaluate and disseminate this information.

Commercialization of Municipal Heating Companies. In the future, all heating providers must operate on commercial principals. This holds especially for the existing heat supply providers who would be closed down if they fail to achieve commercial viability. Being commercial means to build up market-based relations with consumers, suppliers and labor in a competitive environment.

Financial Mechanisms. In the current economic environment in Armenia, households, condominiums, small entrepreneurs and municipal service providers have basically no access to financing. The financial sector is reluctant to provide financing for ventures with perceived high risk. The UHS proposes to establish lending schemes accessible for condominiums as well as for small private entrepreneurs who want to operate small boilers and sell heat to condominiums. An alternative might be to establish credit enhancement and risk sharing mechanisms that would provide comfort to financial institutions to extend credits from their existing funds. Potentially viable technical and institutional models for supplying heating services will have to be tested before many of these financing schemes can be advanced and mainstreamed.

Social and Environmental Concerns. To enable also poor households to take part in collective heat supply, the Government of Armenia should develop a targeted social support scheme, replacing the indirect across-the-board subsidies to district heating. The purpose of the suggested support scheme is to mitigate situations where the potential for chronic non-payment by low-income families within a condominium prevents the condominium from entering into economically efficient contracts for communal services.

Until the UHS is implemented and even afterwards, a large number of families would still have to rely on individual heat sources. Especially the poor would still use wood or dung with the associated environmental problems and social costs. While the deforestation problems should decrease substantially with the implementation of the UHS, deforestation might not cease

completely. The GOA should consider to subsidize the development or the capital cost of efficient wood stoves, particularly in the short-and medium term.

Recommendations

The strategy outline and actions as proposed in the consultants' reports give only a broad outline of the path towards the sustainable provision of heating services in Armenia. Concrete steps to take need to be decided upon by Armenian decision makers. Only then will the extent and the details of the work on all fronts for the coming years become clear. This includes firmer estimates of the costs of implementing the strategy and possible sources of financing.

The key recommendation which relates to all phases of the proposed strategy is to systematically correct market failures to enable consumers the access to affordable and clean heat services. The new role of the state is an enabling role, not the role of an implementer of technically-prescribed solutions. The GOA should set a clear policy regarding the role of the public sector in the heating sector, particularly it should define which actions merit being supported with public funds. With its restricted financial resources, the major role of the Armenian state in the heating sector, and more generally in infrastructure and communal services, should preferably be in the removal of barriers to enable a commercial and private-sector led provision of services. This includes the generation and dissemination of information (through demonstration projects), provision of credit to enable the population to adopt sustainable heating solutions, risk mitigation guarantees during the initial phases of market development, and special support to low-income families. There is also an important regulatory role of the state in network industries, including licensing and tariff setting. For decentralized solutions where competition is easier to establish, and entry and exit from contracts is less costly, a light regulatory approach consisting only of technical licensing is preferable in order not to choke private initiative, and to allow consumers and service providers to agree on the level of service, quality and price in private contracts.

The following actions are deemed necessary for the implementation of the UHS:

- A central implementation unit (CIU) should work with consumer organizations such as condominiums, and heat suppliers to generate interest in participating actively in the UHS implementation and in the proposed Urban Heating Project in particular.
- GoA to embark on an information campaign to inform the public about the UHS and plans and time frame for its implementation. There needs to be a very firm commitment that the GOA will no longer engage in broad subsidization of centralized heating through payment of the natural gas bills for the existing centralized heat supply systems.
- Establishment of criteria for projects that may be eligible for receiving some public funding. It is proposed that during the survival phase public funding should concentrate on those areas where heat consumers are not connected to the centralized heating networks. This would enable a more thorough testing of institutional mechanisms and technologies that could then be scaled up during the next phases.
- GOA to start intensive discussions with the municipalities that were directly involved in the preparation of the UHS about the details of the strategy and local implementation plans.
- Agreement on an action plan for the UHS survival phase. This includes
  - reviewing the heating zones examined during the preparation of the UHS and determining in which zones centralized heating might have a chance to survive without further subsidization
  - agreement on specific actions to take before the coming winter to bring payment capacity of the population and cost of heating in line

- proposed methodology by the Energy Commission for heat tariffs supporting consumption-based billing for centralized heating; publication of a set of licensing requirements for non-regulated heat suppliers, concentrating on environmental and safety criteria;
- inviting condominiums/other consumer groups and interested heat suppliers to participate in the implementation of pilot projects;
- provision of targeted subsidies to low-income households that would facilitate the operation of condominiums and are in line with the existing social support scheme.

If the GOA and the World Bank agree on the financing of the UHP, some of the above actions could be supported during project preparation and receive financing under a Project Preparation Facility. The GOA should require all donors that any support in the heating sector should be in line with the UHS and coordinated through the GOA.